

series of changes, in which the fish, *Lepidosiren*, perenni-branchiate, and triton, are all represented.

One would be inclined to infer from these metamorphoses, that, on tracing the Amphibia back in time, the story of their origin should be told, but, as a matter of fact, palæontological history tells a different story altogether. Abundant remains of frogs and toads are found in the Miocene deposits, some of which are of so fine a character that even the tadpoles are preserved; but these tertiary frogs and toads do not differ, in any important particulars, from those of the present day, and the same is true of the tritons and salamanders. Some of the latter attained a very great size, and one of them—a near ally of the great Japanese salamander of the present day—has had a very singular fate, having been described, about the middle of the last century, as a fossil man, by the German naturalist Scheuchzer, who named it "*Homo diluvii testis*," the man who saw the flood!

In the Wealden and Purbeck formations no Amphibia have as yet been discovered, but, from the Lower Lias to the Carboniferous they turn up again in remarkable numbers, and of great size, but differing from existing forms in some important peculiarities, and affording no help whatever to our inquiries as to the origin of the existing or of the tertiary frogs, toads, and salamanders. Under the throat, these gigantic Amphibia had a remarkable shield of three bony plates, as well as a series of plates along the belly. Their teeth were large and powerful, and presented an extremely complicated structure, whence the group has received its name of *Labyrinthodonta*.

Thus, in tracing back the existing Amphibia, we find a great break in the secondary period, and then come upon a distinct group, the *Labyrinthodonta*, from which the existing forms cannot possibly be deduced. These, again, have been traced no farther back than the carboniferous epoch.

(To be continued.)

### PHYSICAL SCIENCE IN SCHOOLS

THE beginning of a discussion on any great subject elicits mainly differences of opinion; its end should be to establish agreement as to principles, and in great measure as to details. The first half of this dictum has been illustrated by the interesting letters in your columns on Physical Science in Schools; its entire confirmation as the correspondence proceeds will confer on education a benefit of the most timely kind.

The moment is a critical one for scientific teaching. Lord Salisbury's Bill will come to mean a revolution in the educational structure of the Universities; the Report of the Science Commission proposes to re-cast the teaching of the schools; public feeling, unexpressed as yet on other points, is distinct in wishing to see Science heartily recognised and systematically taught. If Science Teachers will agree as to what they want and press it vigorously, the game is in their hands.

I venture to lay down for consideration in NATURE certain propositions on this subject in the hope that they, or such others as may be preferred to them, may become the basis of the agreement we all desiderate:—

1. The business of a school is general education; the business of a University is special education.
2. The principal subjects taught at a school should be Literature, Mathematics, Science.
3. Each of these subjects should be studied in fixed relative proportions of time, from the very beginning of a school course until its close.
4. Scholarships offered for any one of these subjects to the exclusion of the others at the entrance on University life are mischievous in their effect on school teaching, and ought to change their character or be abolished.
5. Science should be taught to every boy in a school

for at least six hours in the week; holding a fair place in Entrance Examinations, being encumbered with no pecuniary charges unimposed on other subjects, and having a value in school-marks proportional to the time spent upon it.

Of these five theses, the first three and the fifth are in exact harmony with the recommendations of the Science Commission; the fourth follows necessarily from the others, as stigmatising a system whose continuance makes general school teaching impossible, and whose significance gains point from the curious admission of one of your correspondents as to the intellectual cost of a Bailliol Scholarship.

The feasibility of teaching science to the youngest schoolboys, assumed in what I have said, demands a word of comment. The evidence on this point scattered through the Report of the Commission, and partly summarised in Report VI., pp. 6–9, is, if not overwhelming, so strong as to outweigh many-fold anything that has yet been said against it. I desire to advance with humility, but with great earnestness, my own experience, extending over fourteen years, in support of the view there laid down; and Mr. West's admirable letter in NATURE, vol. xiii., p. 48, represents, as I well know, the conclusions of many successful teachers. If grammatical analysis and arithmetical numeration are taught every day to boys of nine years old, why not the elements of science? It were well surely to inquire what parts of this vast subject and what treatment of them have been found suitable to younger minds; for the statement on the part of any individual that science cannot be taught to little boys means nothing more than that he himself has failed to teach it.

My object in writing is a practical one. I have stated the principles which seem to me to underlie all school science teaching worthy of the name, and I invoke a judgment upon them, possibly a reversal of them, at the hands of experienced teachers. If it be true, as we were lately told, that the head-masters are awaiting instruction from the public, let us prepare the public to educate their illustrious pupils. At any rate, let scientific men be ready to answer the appeal which will be made to them when the Report of the Science Commission comes before the House of Commons, with such unanimity as only abundant and unprejudiced discussion can generate. To let slip this opportunity will be to find, I fear, with the Jew of Malta, that "Occasion's bald behind."

W. TUCKWELL

I notice in your columns that a discussion has been conducted for some time past on that important subject, Physical Science in School Teaching. Permit me, as one possessing a deep practical interest in this matter, and also as a science teacher of some years' experience, to remark that in Scotland, generally, and in this great educational centre in particular, the chief obstacle which stands in the way of extended science teaching, is the simple apathy of educationalists to the claims of scientific instruction. It were well that, before disagreeing as to the exact mode of teaching, the claims of one science over another, and other points, science teachers should thoroughly agree as to the necessity for more openly enforcing their claims upon the notice of those who sit in high places in the world of educational management. I gladly welcomed an opportunity afforded me by the Edinburgh branch of the "Educational Institute of Scotland," in December last, to address the members of the Institute, consisting in the main of teachers of all subjects, on the "Place, Method, and Advantages of Biological Instruction in Ordinary Education." The substance of that address will shortly appear in *Fraser's Magazine*, and to that medium I would respectfully refer those of your readers who are interested in this question, for a *résumé* of a science teacher's work and method in the northern metropolis. I would fain hope that the argu-

ments therein stated, as applying to the extension of my especial subject—Biology—may be found to suit the case and claims of science teaching at large. And it may not be inappropriate to conclude by re-echoing the remark with which I started, namely, that if we can succeed in creating a demand for science teaching, by showing the honest claims and true value of scientific instruction in an ordinary educational curriculum, we shall have paved the way for a harmonious and natural after-adjustment of such questions as have very ably been ventilated in NATURE during the past few weeks.

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ANDREW WILSON

I have read with considerable interest what may be styled the evidence of your correspondents as to the state of scientific instruction in schools, and I think possibly if your space will permit me, that I shall be able to confirm some of the statements of previous writers. I have reason to believe that in some large schools where science is demanded as a branch of education it is practically suppressed, some of the clever lads are removed from the science classes in order to be "crammed" in classics, sometimes against their own desires, for the purpose, if possible, of making a show in school-lists as having obtained scholarships at Oxford. I am acquainted with facts which cannot be otherwise explained. Sometimes I have learned these from the boys themselves, sometimes from science-masters in different establishments. At one large school in connection with a College there are about 600 boys; formerly very nearly 100 attended chemistry lectures once a week, and about 25 attended the chemical laboratory of the College for 1½ hour. The subject was a voluntary one, and the undoubted interest shown by the scholars was very striking; one could see that they were being taught to think, it was something so entirely different from their ordinary school work. For the last year or two the number of boys attending these science classes has been limited almost entirely to those who intend matriculating at the London University, those whose parents expressly wish their sons to receive such education, or others "the most stupid and ignorant," who are so unlikely to hold their own in any other competition that it is considered they may be better fit for distinction in science. I need hardly say that one fails to make anything of the latter class, although, on the other hand, I have seen such lads display unusual mechanical skill. The number of boys from the school now attending the laboratory is only eight, and those who hear lectures about thirty-six. In a school with unusual facilities for scientific instruction at a small cost, since the teachers, the laboratories, the lecture-rooms, and the very costly scientific apparatus, all belong to the College, there is this small result simply because the pupils are prohibited attending the lectures on science lest, as it is said, "*they should shirk their other work.*" This is certainly not equalising the various branches of human knowledge. In some schools the science masters are appointed not from among those who have made the teaching of science a study, but from that peculiar body who are willing to combine instruction in science (which includes, of course, Physics, Chemistry, Natural History, and Botany), with Mathematics, Classics, and Foreign Languages, and whose views as to the suitable remuneration for their services suggests a limited expenditure of thought, time, and money, on their own acquirements. From the present low estimation in which scientific knowledge is held, I should be exceedingly sorry to see the number of efficient science teachers increased. The capital expended on a classical education gives a far better, a more certain, and a quicker return than that invested in science. Hence the lamentations about the state of science in this country. Until the Head Masters and College dons have been so liberally educated as to understand that besides Classics and Mathematics there are other branches of knowledge which ennoble and enrich

the understanding, and further, until a legal status has been secured for professional scientific men, such things must continue.

W. N. HARTLEY

## NOTES

THE John Hopkins University, some account of the organisation of which we recently published, was formally instituted at Baltimore, U.S., on February 22. Prof. Gilman in his address hinted that elementary instruction in all branches of science is not contemplated at the new University. There will be no stated curriculum of four years. Great freedom is to be allowed both to teachers and to scholars; the former must be "free and competent to make original researches in the library and the laboratory;" the latter will be encouraged to "make special attainments on the foundation of a broad and liberal culture," and to make them through a "combination of lectures, recitations, laboratory practice, field work, and private instruction." Pending the filling of the several professorial chairs, the trustees will ask the most eminent men, both in Europe and America, to come to Baltimore during a term of years, and reside there an appointed time, "and be accessible, *publice et privatim*, both in the lecture-room and in the study." One most important appointment has already been made, by which England will lose, for a time at least, one of her most distinguished mathematicians; Dr. J. S. Sylvester has been appointed to the Chair of Advanced Mathematics, at a handsome salary. Prof. Sylvester will probably enter upon his duties in October next.

THERE is great activity at present at South Kensington; the preparations for the opening of the Scientific Loan Exhibition are in a forward state. A large number of contributions have been already received from France, Germany, Belgium, Holland, and Italy.

CONTRARY to the assertion of a contemporary, who apparently desires to mislead, the men of science of this country are giving the greatest help in the organisation of the Conferences and Conversazioni in connection with the Loan Exhibition; these will be held between May 16 and 31.

H.M.S. *Challenger* arrived at Monte Video on Feb. 15, and was to sail on Feb. 23 for Ascension and St. Vincent. The ship is expected to arrive in England about the end of May.

A CAREFULLY prepared and well classified and indexed Catalogue of Maps, &c., of India, and other parts of Asia, has been prepared by the Geographical Department of the India Office, and published by order of H. M. Secretary of State for India in Council. The Catalogue is accompanied with an Index-Map showing the different sheets which are published or which are being prepared by the engraver for publication.

M. J. CAPELLO, director of the Observatory at Lisbon, has selected Lisbon, Campo-Maior, Angra in the Azores, and Funchal in Madeira, as the stations from which meteorological observations will be furnished for international objects. Their situation, and the fact of their observations being made four times daily, have determined the selection of these four stations. The hours are well suited for purposes of international meteorology.

THE Belgian Academy of Sciences offers prizes for papers on the following subjects, to be sent to the Secretary, M. J. Liagre, at the Museum, Brussels, before Aug. 1, 1877:—1. To give a *résumé* of works which have appeared on the theory of continued fractions, and to improve it in some important point. 2. To examine and discuss, on the basis of new experiments, the perturbing causes which bear on determination of the electro-motive force, and on the internal resistance of an element of the electric pile; to exhibit in numbers these two quantities for some of the